Ash Creek Associates
Environmental and Geotechnical Consultants

December 18, 2012

Mr. Dwight Leisle
Port of Portland
7200 NE Airport Way
Portland, Oregon 97218

Re: Riverbank Sampling — Operable Unit 1
Swan Island Upland Facility
Portland, Oregon
ECSI No. 271
1115-06

Dear Mr. Leisle:

This letter presents the results of riverbank sampling activities completed to support the Port of Portland (Port) Source Control Evaluation (SCE) activities for Operable Unit 1 (the Facility or OU1) at the Swan Island Upland Facility (SIUF) in Portland, Oregon (Figures 1 and 2). The Port is under a Voluntary Cleanup Program (VCP) Agreement with the Oregon Department of Environmental Quality (DEQ) for Remedial Investigation (RI), Source Control Measures (SCMs), and Feasibility Study (FS) at the Facility (dated July 24, 2006). The DEQ approved the *Proposed Riverbank Sampling Work Plan* (the Work Plan; dated June 15, 2012) in a letter dated June 28, 2012. The methods, procedures, and results of the field reconnaissance and chemical analyses are presented in this letter.

SAMPLING ACTIVITIES

Preparatory Activities

The following activities were completed in preparation for the field work.

- Health and Safety Plan (HASP). Ash Creek Associates, a Division of Apex Companies, LLC, (Ash Creek) prepared a HASP for its personnel involved with the project.
- Vigor Coordination. The work activities were conducted in coordination with Vigor schedules.

Riverbank Reconnaissance

On August 20 through 24, 2012, Ash Creek completed a visual reconnaissance of the OU1 riverbank. The entire length of the bank around OU1 was observed and mapped using visual observations made while walking along the riverbank where possible. Observations under the lagoon side docks (previously referred to as the old pier) were made from the catwalk that runs the length of the pier. Observations of the riverbank area east of the lagoon side docks were made from the berths and foot piers extending over the riverbank from the main asphalt concrete dock area (due to the presence of heavy vegetation and the steepness of the riverbank slope). Figure 3 through 6 show the results of the visual mapping, identifying observed geomorphic features. A log presenting representative photographs is included in Attachment A.

The OU1 riverbank was broken into four sections for reconnaissance and mapping purposes, those sections are listed below.

- The river side docks (previously referred to as the new pier) on the Willamette River side of the Facility;

- The riverbank in the vicinity of the Ballast Water Treatment Plant (BWTP);
- The lagoon side docks on the Swan Island Lagoon side of the Facility; and
- The lagoon side bank.

In general, the surface condition of the riverbank is characterized by dense vegetation above the approximate ordinary line of high water (OLHW – identified based on visual determination of the location where predominantly upland vegetation was present), with the exception of the riverbank underneath the pier structures, which does not support vegetation. Where vegetation was observed, it generally consists of grasses, shrubs, and small trees, with occasional vine and ground cover. Below the OLHW, the bank generally consists of riprap. Evidence of a historical wooden retaining wall was observed running the length of the Facility along the Lagoon side of OU1 under the dock structure and along the riverbank area to the east. Portions of the retaining wall have deteriorated, leading to some loss of the riverbank (see Photographs 14 through 18 from the Work Plan). The remainder of the retaining wall is bowing under the pressure of the riverbank material, which could lead to a potential failure.

Locally, various surface features (designated A through BD) were observed and mapped. The observed features are identified on Figures 3 through 6 and discussed below, according to the mapped section.

River Side Docks

The riverbank under the river side docks is generally comprised of a riprap armoring up to a sheet-pile bulkhead. Areas of specific observations are presented below. The OLHW was approximated by measuring down from the dock structure using a stadia rod.

- A – Erosion scarp. The scarp is above the OLHW, approximately 80 feet long, and 1 to 4 feet high. The scarp is comprised of cemented sand and riprap overlain by concrete in areas (appears to be a remnant of the concrete poured when the dock structure was constructed).
- B – Erosion scarp. The scarp is above the OLHW, approximately 125 feet long, and 2 to 3.5 feet high. The scarp is comprised of cemented sand and riprap. Sample OU1-RB6 was collected from the face of this scarp.
- C – Erosion scarp. The scarp is above the OLHW, approximately 310 feet long, and 1.5 to 7 feet high (over-vertical in some areas). The scarp is comprised of cemented sand, gravel and riprap. Sample OU1-RB7 was collected from the face of this scarp.
- D – Erosion scarp. The scarp is above the OLHW, approximately 15 feet long, and 2.5 to 3 feet high.
- E – Scarp complex. This feature is comprised of a series of small scarps extending up riverbank above OLHW close to the sheet-pile bulkhead and is approximately 25 feet in length. The scarps are comprised of a cemented mixture of sand and gravel.
- F – Small area of bare soil near the OLHW.
- G – Exposed soil, sand and gravel, cemented, at an approximate 50-degree slope. This feature is at the sheet-pile bulkhead and is approximately 30 feet in length.
- H – Erosion scarp. The scarp is above the OLHW, approximately 20 feet long and 6 inches high. The scarp is comprised of sand.
- I – Erosion scarp. The scarp is above the OLHW, approximately 15 feet long and 6 inches high. The scarp is comprised of sand.
- J – Erosion scarp. The scarp is above the OLHW, approximately 15 feet long and 1.5 feet high. The scarp is comprised of cemented sand and riprap. This feature is against the sheet-pile bulkhead.

- K – Erosion scarp. The scarp is above the OLHW, approximately 15 feet long and 1 foot high. The scarp is comprised of cemented sand and riprap. This feature is against the sheet-pile bulkhead.
- L – Erosion scarp. The scarp is above the OLHW, approximately 80 feet long and 1 to 1.5 feet high. The scarp is comprised of cemented sand and riprap. This feature trends toward the sheet-pile bulkhead, which is exposed at the east end of the scarp.
- M – Small area of bare silt near OLHW located around piling.
- N – Erosion scarp. The scarp is above the OLHW, approximately 55 feet long and 1 to 1.5 feet high. The scarp is comprised of loose sand with some riprap. Sample OU1-RB8 was collected from the face of this scarp.
- O – Small exposed silt bench below OLHW.
- P – Erosion scarp. The scarp is above the OLHW, approximately 15 feet long, and 1 to 1.5 feet high. The scarp is comprised of cemented sand and riprap. This feature trends from the back sheet-pile bulkhead, which is exposed at the west end of the scarp.
- Q – Erosion scarp. The scarp is above the OLHW, approximately 65 feet long, and 1 to 1.5 feet high. The scarp is comprised of cemented sand and riprap. Sample OU1-RB9 was collected from the face of this scarp.
- R – Erosion scarp. The scarp is above the OLHW, approximately 15 feet long and 1 foot high. The scarp is comprised of cemented sand and riprap.
- S – Erosion scarp. The scarp is above the OLHW, approximately 135 feet long and 1 foot high. The scarp is comprised of cemented sand and riprap.
- T – Erosion scarp. The scarp is above the OLHW, approximately 85 feet long and 1 foot high. The scarp is comprised of medium sand and riprap.
- U – Erosion scarp. The scarp is above the OLHW, approximately 15 feet long and 1 foot high. The scarp is comprised of cemented sand and riprap.
- V – Erosion scarp. The scarp is above the OLHW, approximately 8 feet long and 0.8 foot high. The scarp is comprised of cemented sand and riprap.
- W – Erosion scarp. The scarp is above the OLHW, approximately 40 feet long and 0.8 foot high. The scarp is comprised of cemented sand and riprap.
- X – Erosion scarp. The scarp is above the OLHW, approximately 60 feet long and 0.5 foot high. The scarp is comprised of loose sand and silt. This scarp is located below and undercut section of the sheet-pile bulkhead wall.
- Y – Erosion scarp. The scarp is above the OLHW, approximately 100 feet long and 1 foot high. The scarp is comprised of cemented sand and riprap.
- Z – Erosion scarp. The scarp is above the OLHW, approximately 65 feet long and 1 foot high. The scarp is comprised of cemented sand and riprap.
- AA – Erosion scarp. The scarp is above the OLHW, approximately 40 feet long and 1 foot high. The scarp is comprised of cemented sand and riprap.
- AB – Erosion scarp. The scarp is above the OLHW, approximately 15 feet long and 0.5 foot high. The scarp is comprised of cemented sand and riprap.

In summary, the riverbank under the river side docks is characterized by riprap armoring from below OLHW to the sheet-pile bulkhead. Of the 28 features identified, only four of these features consist of erosion scarps comprised of loose erodible material (Features H, I, N, and X). The erosion scarps are linear or slightly concave features running

parallel to the riverbank. They are located at or above the approximate OLHW and likely the result of wave action (caused primarily by vessel wakes).

Riverbank in Vicinity of BWTP

The riverbank in the BWTP area is generally comprised of a riprap armoring up to a transition to vegetation (the presume OLHW). Areas of specific observations are presented below.

- AC – Erosion scarp. The scarp is above the OLHW, approximately 60 feet long and 1 to 2 feet high. The scarp is comprised of cemented sand and riprap and extends from under the river side dock. Sample OU1-RB11 was collected from this feature.
- AD – Erosion scarp. The scarp is above the OLHW, approximately 90 feet long and 1 to 1.5 feet high. The scarp is comprised of cemented sand and riprap. Sample OU1-RB12 was collected from this feature
- AE – Bare soil. Loose and disturbed soil extending upslope from OLHW within riprap.
- AF – Erosion scarp. The scarp is above the OLHW, approximately 20 feet long and 2 to 3 feet high. The scarp is comprised of cemented sand and riprap. Sample OU1-RB13 was collected from this feature
- AG – Erosion scarp. The scarp is above the OLHW, approximately 30 feet long and 2 to 3 feet high. The scarp is comprised of dense sand and riprap.
- AH – Bare soil. Exposed and bare soil within riprap armoring. This feature is approximately 30 feet in length and extends upslope from the OLHW. Sample OU1-RB14 was collected from this feature.
- AI – Erosion scarp complex. Series of small scarps and patches of bare soil observed over a 45-foot section of riverbank. The majority of these features are located above the OLHW.
- AJ – Bare soil. Exposed soil observed under thin vegetation. Several small scarps, less than 2 feet high, were observed above OLHW along an approximate 25-foot length of riverbank. The scarps are comprised of sand and riprap. Sample OU1-RB15 was collected from this feature.
- AK – Erosion scarp. The scarp is above the OLHW, approximately 20 feet long and 3 inches high.
- AL – Erosion scarp. The scarp is above the OLHW, approximately 25 feet long, and 3 to 4 feet high. The scarp is comprised of sand, gravel, and cemented riprap. This feature is located below two small-diameter outfalls (4 and 8 inches in diameter), but it is unclear if these outfalls are active. Sample OU1-RB16 was collected from this erosional feature.
- AM – Erosion scarp. The scarp is predominantly above the OLHW, approximately 40 feet long, and 2 to 3 inches high.
- AN – Erosion rills. Small, 1- to 2-foot-wide erosional rills extending from the wide flat bench, downslope to the riverbank. Most of these features are located under vegetative cover.
- AO – Erosion scarp. Scarp adjacent to an area paved with asphalt-concrete. Feature is approximately 25 feet in length and is located above the OLHW. Sample OU1-RB17 was collected from this feature.

In summary, the riverbank in the vicinity of the BWTP is characterized by riprap and dense vegetation. The observed erosion scarps are generally linear or slightly concave features running parallel to the riverbank and located at or above the transition from riprap to vegetation.

Lagoon Side Docks

The riverbank under the lagoon side docks is generally comprised of a riprap armoring up to a sheet-pile bulkhead. A historical wooden retaining wall structure observed along the lagoon side of the Facility has deteriorated under the

docks. Only the angled support beams are still visible (Photograph 23). Areas of specific observations are presented below. The OLHW was approximated by measuring down from the dock structure using a stadia rod.

- Approximately ten locations were observed where a thin layer of sand was present on and surrounded by riprap (Photographs 16, 17, and 19). These areas were attributed to deposition during periods of high water. These areas were commonly observed on one or both sides of the bulkhead walls that separate the catwalk (i.e., locations were water slows down and allows for settling). These individual areas do not represent a significant volume of material and were therefore not sampled for laboratory analysis.
- AQ – Erosion scarp. The scarp extends from below the OLHW in the vicinity of a 36-inch corrugated metal outfall where the outer segment of the outfall pipe has become disconnected. The riverbank under the outfall forms a small cove. The scarp extends upslope beyond a small metal sheet-pile bulkhead. The scarp is comprised of loose silty sand with occasional gravels, and measures approximately 20 to 25 feet in length. Sample OU1-RB18 was collected from the face of this scarp.
- AR – Black grit observed along an approximately 20-foot section on the bench at top of riverbank.
- AS – Bare soil. Loose, gravelly sand with several small erosional features on surface of riverbank.
- AT – Bare soil. Flat bench at top of riverbank extending approximately 5 to 10 feet from edge of riverbank to back sheet-pile bulkhead.
- AU – Erosion scarps. Erosional scarps comprised of sand with overlying black grit. Sample OU1-RB19 was collected from the face of this slope.

In summary, the riverbank under the lagoon side docks is characterized by riprap armoring to the sheet-pile bulkhead with areas of loose sand and occasional erosion scarps in the eastern third of the docks.

Lagoon Riverbank

The riverbank east of the lagoon side docks is generally comprised of riprap armoring up to the transition to vegetation. A historical wooden retaining wall structure observed along the lagoon side of the Facility has deteriorated in some locations. Areas of specific observations are presented below.

- AV – Erosion scarp. The scarp is above the OLHW, approximately 25 feet long, extending east from the eastern edge of docks, and 1 foot high.
- AW – Erosion scarp. The scarp is at or above the approximate OLHW underneath a corrugated metal outfall, approximately 20 feet long and 4 feet high. Sample OU1-RB1 was collected from this feature.
- AX – Bare soil. Bare soil on riverbank above OLHW with some vegetative cover and occasional concrete blocks and debris.
- AY – Erosion scarps. Series of erosional scarps present on riverbank at and above OLHW in the vicinity of an outfall. The outfall pipe has become disconnected and water discharges near the top of the slope. The scarps are approximately 10 feet high and vary in length from 10 to 30 feet. Sample OU1-RB2 was collected from the collected from one of the larger features at this location.
- AZ – Bare soil. Bare soil above OLHW on riverbank, approximately 8 feet by 8 feet.
- BA – Erosion scarp. Erosion scarp above OLHW parallel to riverbank under cat walk. The scarp is approximately 30 to 35 feet in length and 1 to 2 feet high. Sample OU1-RB3 was collected from this feature.
- BB – Erosion scarp. The scarp is above the OLHW under the outfall pipe, approximately 15 feet long and 1 to 2 feet high. Sample OU1-RB4 was collected from this feature.
- BC – Bare soil. Bare soil above OLHW extending from the middle to the top of the slope, approximately 6 feet by 12 feet.

- BD – Erosion scarp. The scarp is above the OLHW, approximately 40 feet long and 1 foot high. The scarp extends from the Berth 307 east along riverbank onto Operable Unit 3. Sample OU1-RB5 was collected from this feature.

In summary, the riverbank is characterized by riprap and dense vegetation most of the riverbank just below the OLHW. A wooden retaining wall below the OLHW has deteriorated in some locations. The observed erosion scarps are generally linear or slightly concave features running parallel to the riverbank and located at or above the transition from riprap to vegetation.

Soil Sampling

Figure 2 shows the 19 soil sampling locations (OU1-RB1 through OU1-RB19; established based on observations of potentially erodible soil above the OLHW). The samples were collected in accordance with Standard Operating Procedure (SOP) 2.2 (Attachment B). The samples were field screened for volatile organic compounds (VOCs) using a photoionization detector (PID) and for the presence of petroleum hydrocarbons using a sheen test in accordance with SOP 2.1 (Attachment B). No field indications of VOCs or petroleum hydrocarbons were observed.

With the exception of the samples collected under the docks, the sample locations were recorded using a high-accuracy, handheld global positioning system (GPS) device (Trimble© GeoXH™). Under the docks, locations were approximated using the piling number and the average spacing between pilings to approximate the lateral location. Vertical locations, relative to OLHW, were determined by measuring from the underside of the dock surface.

The sample locations are described below.

- Five samples were collected under the river side docks;
- Seven samples were collected in the vicinity of the BWTP;
- Two samples were collected under the lagoon side docks; and
- Five samples were collected on the lagoon riverbank east of the docks.

CHEMICAL ANALYSES

The soil samples collected from the above activities were submitted to Pace Analytical Services, Inc. in Seattle, Washington for chemical analysis. Copies of the laboratory reports are included in Attachment C (in CD-Rom format due to the length of the Level III deliverable report). The samples were analyzed on a standard turnaround time (up to 10 business days). A quality assurance review of the data was completed. No qualifiers were attached to the data as a result of our review.

The soil samples were analyzed for the following laboratory analyses. The results are presented in Table 1.

- Polychlorinated biphenyls (PCBs) by EPA Method 8082 (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268).
- Priority pollutant 13 metals by EPA 6000/7000 Series Methods;
- Polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270-SIM; and
- Butyl tins by the Krones Method.

CONCLUSIONS

These data will be evaluated in the *Source Control Evaluation.*

If you have any questions regarding these activities, please contact the undersigned at (503) 924-4704.

Sincerely,

Michael J. Pickering, R.G.
Senior Associate Hydrogeologist

ATTACHMENTS

Table 1 – Riverbank Soil Analytical Results

Figure 1 – Facility Location Map
Figure 2 – Site Vicinity Plan
Figure 3 – River Side Docks
Figure 4 – Vicinity of BWTP
Figure 5 – Lagoon Side Docks
Figure 6 – Lagoon Riverbank

Attachment A – Photograph Log
Attachment B – Standard Operating Procedures 2.1 and 2.2
Attachment C – Laboratory Analytical Report (CD-ROM)

Table 1 - Riverbank Soil Analytical Results
SIUF - OU1
Portland, Oregon

Sample ID:	OU1-RB1	OU1-RB2	OU1-RB3	OU1-RB4	OU1-RB5	OU1-RB6	OU1-RB7	OU1-RB8	OU1-RB9	OU1-RB10	OU1-RB11	OU1-RB12	OU1-RB13	OU1-RB14	OU1-RB15	OU1-RB16	OU1-RB17	OU1-RB18	OU1-RB19	JSCS
Sample Date:	8/21/2012	8/21/2012	8/21/2012	8/21/2012	8/21/2012	8/23/2012	8/23/2012	8/23/2012	8/23/2012	8/23/2012	8/23/2012	8/23/2012	8/23/2012	8/23/2012	8/23/2012	8/24/2012	8/24/2012	8/24/2012	8/24/2012	SLV
Metals by EPA 6000/7000 Series (mg/kg)																				
Antimony	4 J	27.8	1.7 J	2.6 J	1.3 J	3.5 J	6.4	1.2 J	1.7 J	1.4 J	2.8	2.8	3.1 J	2.2	2 J	2.1 J	4.6	2 J	8	64
Arsenic	3.6 J	849	3.3	5	2.3	3.7 J	6.8	2.7	3.8	2.6	10.4	4.9	4.1 J	4.9	4	4.3 J	31.1	2.9	16.9	7
Beryllium	0.54	<0.04	0.14	0.46	0.15	0.74	0.59	0.17	0.19	0.16	0.21	0.31	0.5	0.25	0.22	0.53	0.31	0.13	0.22	--
Cadmium	4.95	5.08	1.66	2.58	1.59	4.82	3.74	1.51	2.11	1.57	2.07	2.65	4.5	2.3	2.26	4.77	3.17	1.91	6.21	1
Chromium	30.1	213	16.8	28.4	15.7	7.4	30.2	13.4	24.4	13.2	30.8	39	21.9	41.4	22.2	19.1	35.6	18.2	227	111
Copper	155	8,400	31.1	42.7	21.7	25.7	151	17.7	129	17.9	97	132	103	102	97.3	74	381	25	1,000	149
Lead	107	742	56.1	33.9	12.5	<0.9	30.9	<0.4	42.9	<0.4	38.5	65	1.2 J	38.7	21.2	<1.0	56.8	<0.4	147	17
Mercury	0.071	85	0.081	0.233	0.082	0.028	0.231	0.009	0.571	0.091	0.166	0.156	0.1	0.353	0.074	0.114	0.078	0.023	0.03	0.07
Nickel	15.8	40.8	14.7	14.2	16.5	2.39	18.8	15.3	16	14.2	19.7	84.5	14.2	21.2	16.1	14.4	30.1	16.4	111	48.6
Selenium	<1.7	0.9 J	<0.7	<1.7	<0.7	<1.6	<1.8	<0.6	0.7 J	0.7 J	<0.6	<0.6	<1.7	0.7 J	<0.7	<1.7	<0.7	0.8 J	1.8 J	2
Silver	0.6 J	0.3 J	<0.2	<0.5	<0.2	<0.5	0.5 J	<0.2	<0.2	<0.2	0.2 J	0.3	<0.5	0.3 J	0.2 J	<0.5	0.4 J	<0.2	1.1	5
Thallium	<1.0	<0.04	<0.4	<1.0	<0.4	<0.9	<1.0	<0.4	<0.4	<0.4	<0.4	<0.4	<1.0	<0.4	<0.4 ND	<1.0	<0.4	<0.4	<0.4	--
Zinc	405	2,980	104	173	63.6	108	200	46.9	112	53.6	161	166	128	142	145	89.4	812	84.6	700	459
Polychlorinated Biphenyls by EPA Method 8082 (µg/kg)																				
Aroclor 1016	<2.1	ND	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	530
Aroclor 1221	<2.1	ND	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	--
Aroclor 1232	<2.1	ND	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	--
Aroclor 1242	<2.1	ND	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	--
Aroclor 1248	<2.1	28,000	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	1,500
Aroclor 1254	94	ND	<2.1	19	<2.1	<2.1	62	<2.1	56	<2.1	75	<210	19	74	<2.1	<2.1	49	<2.1	72	300
Aroclor 1260	59	ND	77	27	<2.1	4.5 J	85	<2.1	30	<2.1	91	590	27	96	140	620	53	<2.1	40	200
Aroclor 1262	<2.1	ND	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	--
Aroclor 1268	<2.1	ND	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	--
Total PCBs	153	28,000	77	46	<2.1	<2.1	147	<2.1	86	<2.1	166	590	46	170	140	620	102	<2.1	112	0.39
Polycyclic Aromatic Hydrocarbons by EPA Method 8270M-SIM (µg/kg)																				
1-Methylnaphthalene	2.6	27	3.1 J	1.3 J	7.8	<0.51	1.9 J	<0.51	1 J	<0.51	1.3 J	3.8 J	1.4 J	1.2 J	1.2 J	0.79 J	6.2	1.6 J	11	--
2-Methylnaphthalene	3.9	40	4.2 J	2.5 J	5.1	<0.46	3.1 J	<0.46	1.6 J	<0.46	1.7 J	4.1 J	2 J	1.8 J	1.4 J	1.2 J	6.4	3.1 J	13	200
Acenaphthene	5.4	47	12	2.5 J	53	<0.76	1.8 J	<0.76	<0.76	<0.76	2.7 J	4.2 J	2 J	1.8 J	1.3 J	<0.76	10	<0.76	26	300
Acenaphthylene	3.2	450	12	3.2 J	45	<0.59	3.1 J	0.68 J	4.2 J	<0.59	3.8 J	6.8	2.5 J	3.9 J	2.3 J	2 J	5.2	12	11	200
Anthracene	6.8	310	35	4.6 J	55	1.5 J	7.1	1.2 J	3.2 J	<0.58	7.9	13	4.1 J	4.9	3.6 J	2.4 J	14	6.7	50	845
Benz(a)anthracene	42	2,500	80	22	230	6.4	27	7.1	19	0.8 J	45	57	20	32	21	13	76	50	120	1,050
Benzo(a)pyrene	36	5,700	98	29	190	6.6	28	5	34	<0.76	55	62	23	39	29	12	110	1.7 J	150	1,450
Benzo(b)fluoranthene	87	8,400	100	44	210	10	49	5	54	<0.92	75	88	42	66	51	28	150	100	250	--
Benzo(g,h,i)perylene	51	6,300	89	43	140	8.1	42	1.9 J	58	<0.85	56	58	29	52	39	22	110	12	190	300
Benzo(k)fluoranthene	29	2,800	41	14	82	4	21	2.2 J	19	<0.87	29	37	15	25	19	12	55	33	86	13,000
Chrysene	74	2,300	100	28	270	7.4	37	7.8	29	<0.80	60	75	29	43	32	16	82	90	140	1,290
Dibenz(a,h)anthracene	11	1,600	11	6.3	32	1.6 J	7.9	<0.80	11	<0.80	9.4	9.4	5.4	8.7	6.3	4.5 J	22	9.2	25	1,300
Fluoranthene	110	2,600	210	56	490	9.4	46	3.3 J	24	<0.98	82	130	42	55	43	22	210	150	330	2,230
Fluorene	4.9 J	50	8.3	2.4 J	17	0.62 J	2.2 J	<0.61	0.88 J	<0.61	2.7 J	6.4	2.1 J	1.7 J	1.3 J	0.69 J	9.6	0.95 J	28	536
Indeno(1,2,3-cd)pyrene	49	6,100	74	32	130	7.2	37	2.1 J	51	<0.87	52	57	25	46	34	18	100	55	150	100
Naphthalene	5.8	60	9.5	3.8 J	11	0.93 J	3.1 J	0.72 J	2.3 J	0.62 J	2.7 J	9.4	3.4 J	2.9 J	2.8 J	2.4 J	7.7	4.4 J	14	561
Phenanthrene	57	990	130	24	340	5.2	19	<1.4	8.1	<1.4	36	76	18	18	17	7.4	120	26	220	1,170
Pyrene	100	4,600	240	71	520	11	51	5.1	33	0.77 J	89	140	45	63	47	24	200	160	310	1,520
Butyl Tins by Krones Method (µg/kg)																				
Dibutyltin Ion	28	1.3	1.6	2.5	<0.20	<0.26	7.8	<0.21	0.78 J	<0.26	37	32	13	24	85	2.6	400	<0.21	11	--
Butyltin Ion	28	<0.28	1.6	3.4	<0.27	3.6	4.2	<0.29	0.86 J	<0.35	81	32	33	19	35	6.7	460	<0.29	8.9	--
Tetrabutyltin Ion	<0.47	<0.47	<0.46	<0.46	<0.46	<0.60	<0.48	<0.48	<0.47	<0.59	<0.46	<0.46	<0.47	<0.45	<4.5	<0.47	3.6	<0.48	<0.46	--
Tributyltin Ion	57	4.3	0.87 J	2.8	<0.45	3.8	3.9	<0.47	<0.45	<0.57	83	65	96	20	430	5.1	990	<0.47	17	2.3

Notes:

1. µg/kg (ppb) = micrograms per kilogram (parts per billion)
2. mg/kg (ppm) = milligrams per kilogram (parts per million)
3. < = Not detected above the method reporting limit (MRL)
4. JSCS = Screening levels from Portland Harbor Joint Source Control Strategy – Final (Table 3-1 Updated July 16, 2007). December 2005.
5. Shading denotes exceedence of JSCS SLV.
6. J = Estimated.

NOTE: Base map prepared from USGS 7.5-minute quadrangles as provided by Topozone. (1990)

0 2,000 4,000

Approximate Scale in Feet

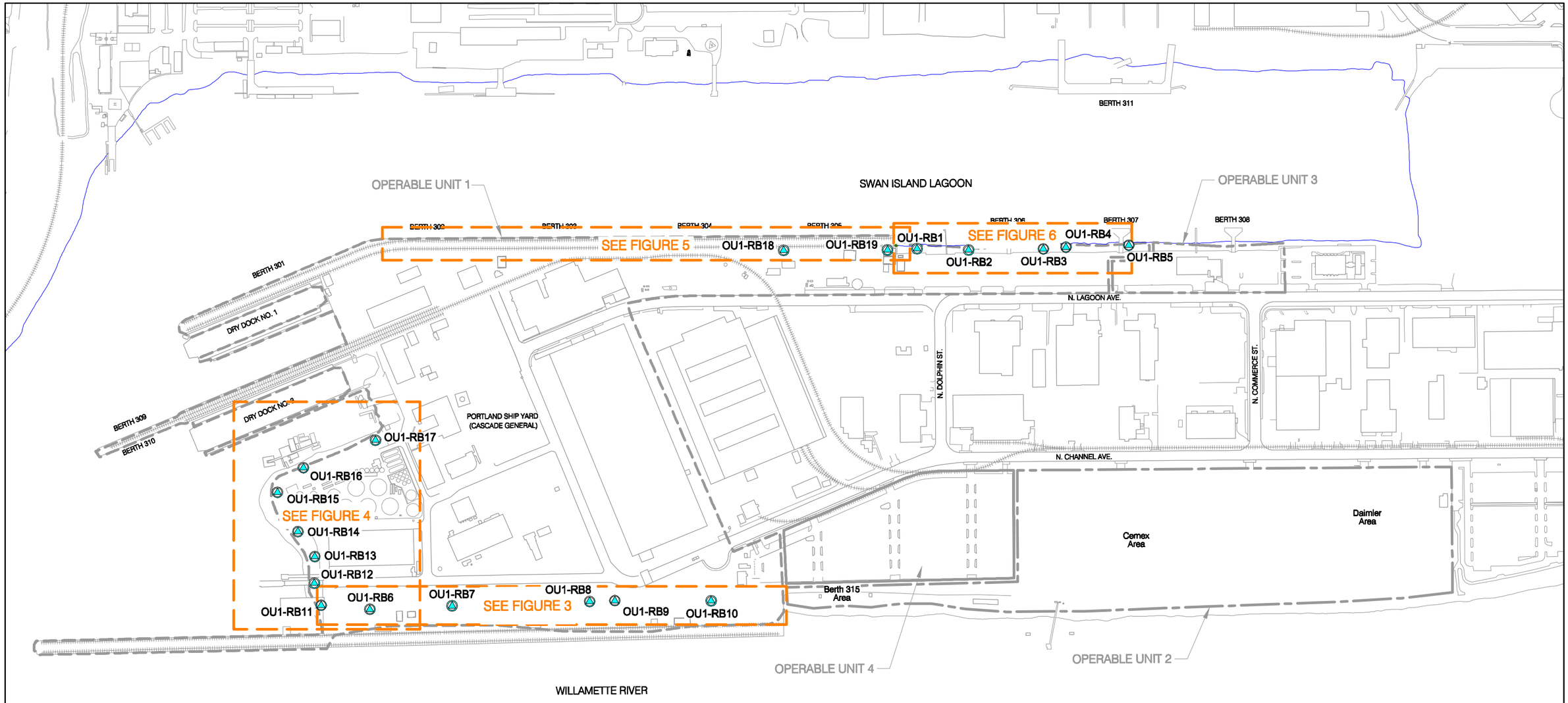
N

Facility Location Map

Riverbank Sampling Letter Report
Swan Island Upland Facility Operable Unit 1
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1115-06	Figure
November 2012		1



Legend:

OU1-RB1 Sampling Location

Operable Unit 1 Boundary

Operable Unit 2 Boundary

Operable Unit 3 Boundary

Operable Unit 4 Boundary

N

0 400 800

Scale in Feet

NOTE:

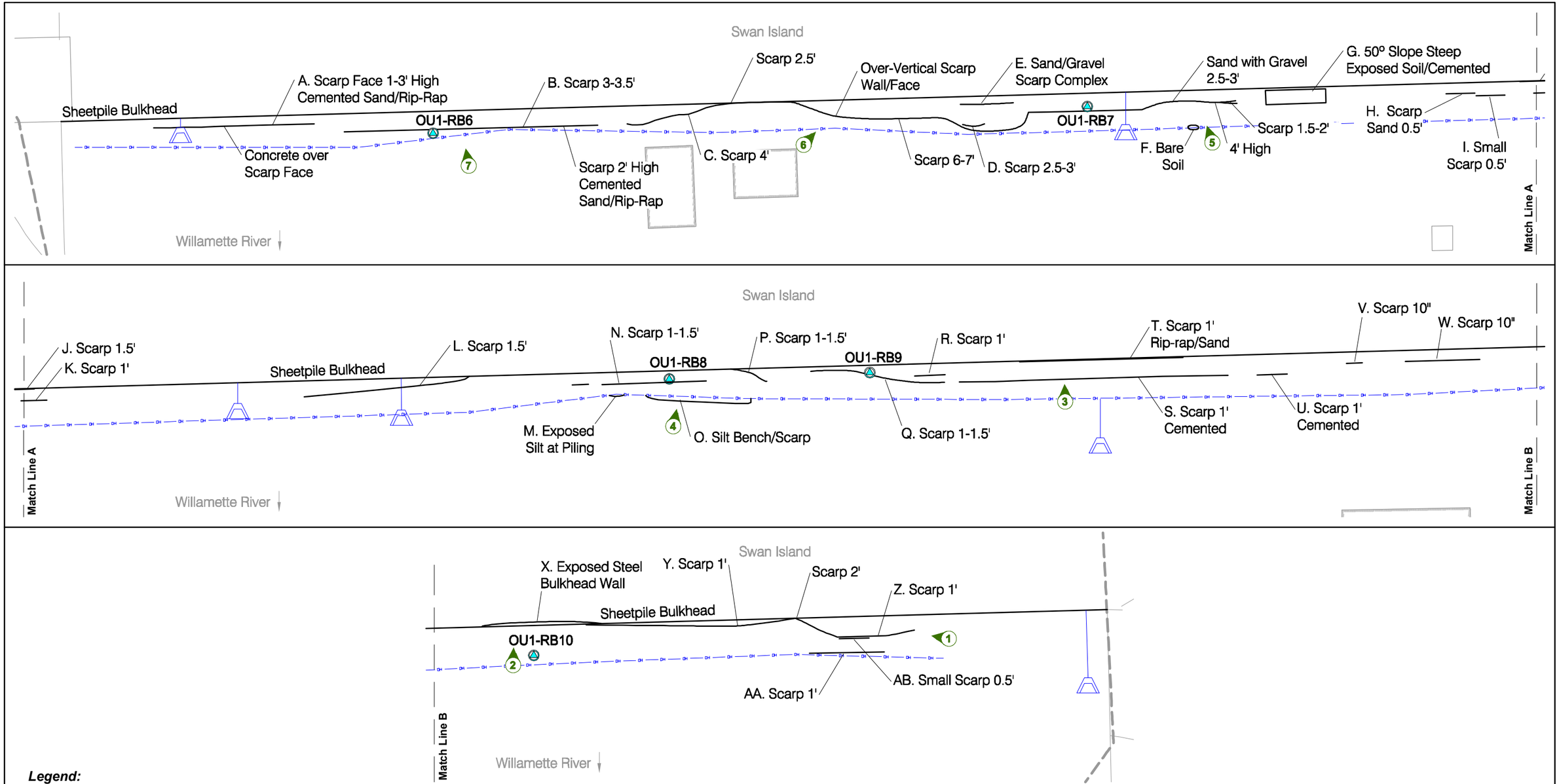
1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.

Site Vicinity Plan

Riverbank Sampling Letter Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

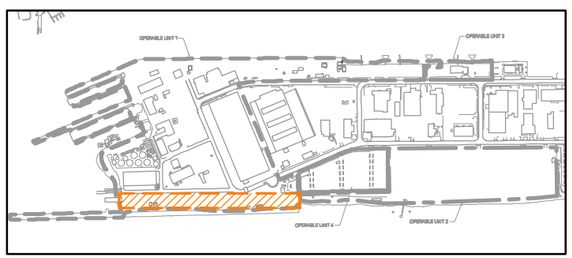
Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1115-06	Figure
November 2012		2



Legend:

- **OU1-RB6** Riverbank Soil Sampling Location
- (1) Photograph Location, Number, and Direction Taken
- Ordinary High Water Line (Approximate)
- Approximate Outfall Location
- Operable Unit 1 Boundary



N

0 50 100

Scale in Feet

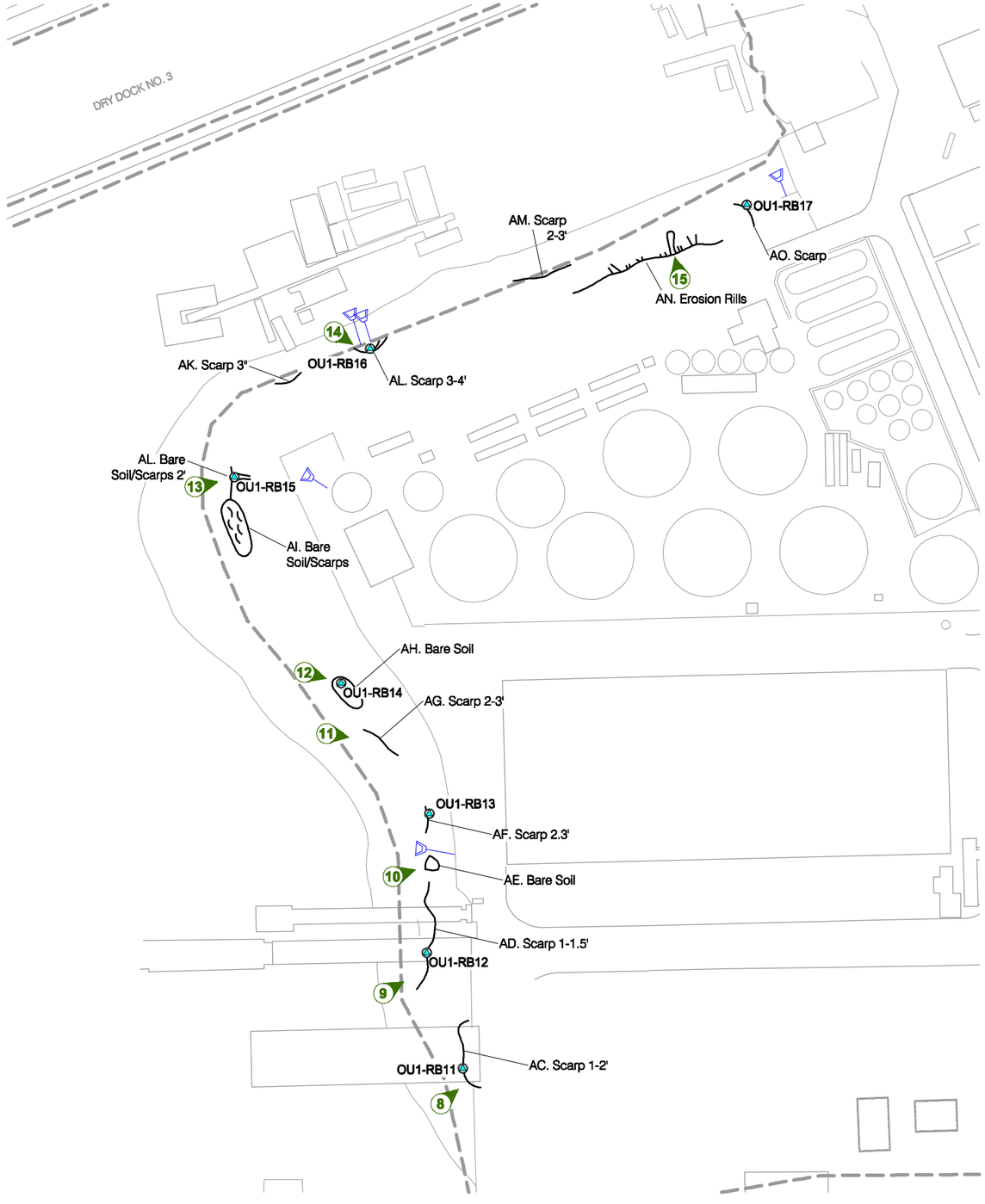
NOTE:
1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.

River Side Docks

Riverbank Sampling Letter Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Ash Creek Associates, A Division of Apex Companies, LLC — APEX

Project Number	1115-06	Figure
November 2012		3



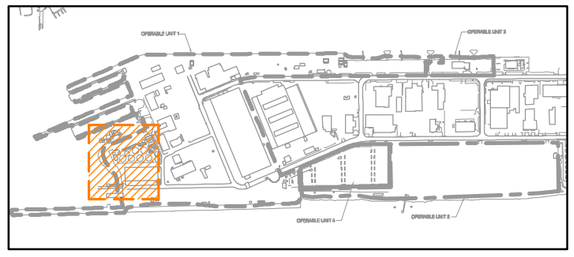
Legend:

OU1-RB6 Riverbank Soil Sampling Location

25 Photograph Location, Number, and Direction Taken

Approximate Outfall Location

Operable Unit 1 Boundary



N

0 100 200

Scale in Feet

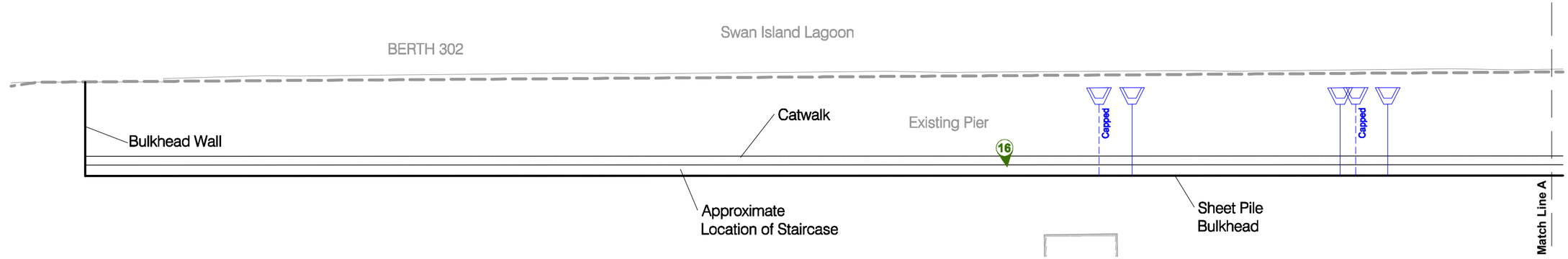
NOTE:
1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.

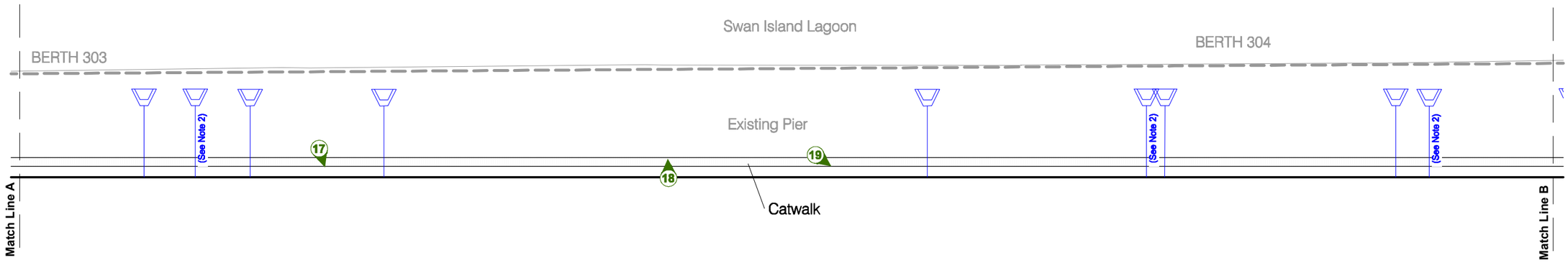
Vicinity of BWTP

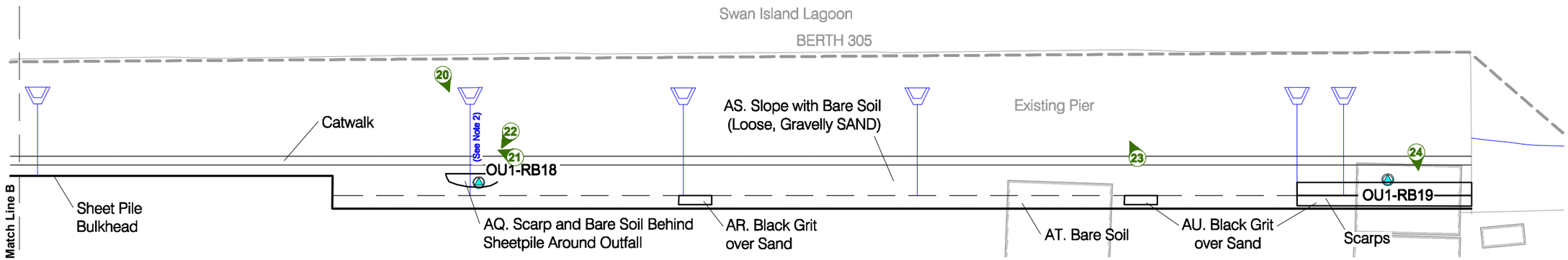
Riverbank Sampling Letter Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1115-06	Figure
November 2012		4

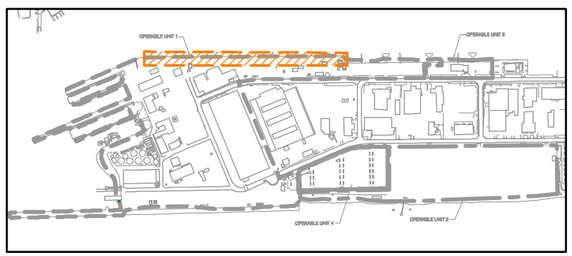






Legend:

- OU1-RB18 — Riverbank Soil Sampling Location
- 25 — Photograph Location, Number, and Direction Taken
- Approximate Outfall Location
- Operable Unit 1 Boundary



N

0 50 100

Scale in Feet

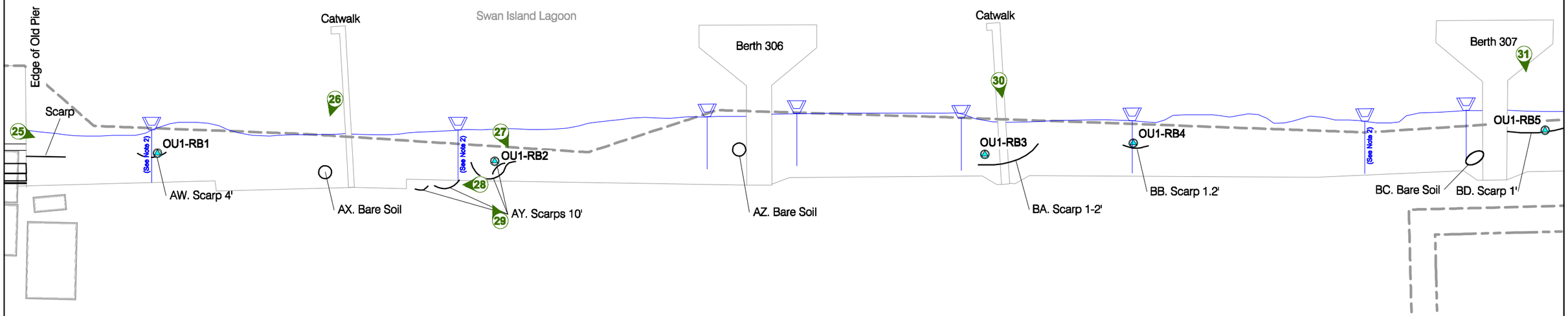
NOTE:
1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.
2. Outfall pipe needs repair (e.g., separated/fallen Segment allowing water to discharge further upslope).

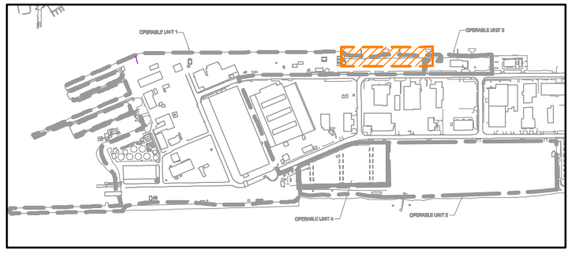
Lagoon Side Docks

Riverbank Sampling Letter Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1115-06	Figure
November 2012		5





Legend:

- **OU1-RB1** Riverbank Soil Sampling Location
- 1 Photograph Location, Number, and Direction Taken
- Approximate Outfall Location
- Operable Unit 1 Boundary
- Operable Unit 3 Boundary

N

0 60 120

Scale in Feet

NOTE:

1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.
2. Outfall pipe needs repair (e.g., separated/fallen Segment allowing water to discharge further upslope).

Lagoon Riverbank

Riverbank Sampling Letter Report
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1115-06	Figure
November 2012		6

Attachment A

Photograph Log

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1
Project Number: 1115-06
Client: Port of Portland
Location: Portland, Oregon

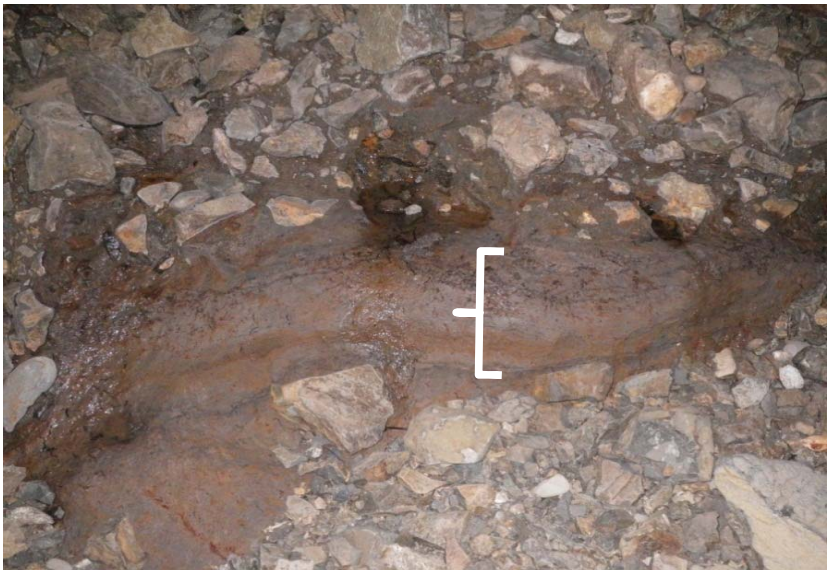
Photo No: 1	
Photo Date: 8/5/2011	
Orientation: Northwest	
Description: Feature Z - White bracket highlights scarp face.	

Photo No: 2	
Photo Date: 8/22/2012	
Orientation: Northeast	
Description: Vicinity of Feature X showing exposed sheet-pile bulkhead wall.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 3 **Photo Date:** 8/22/2012 **Orientation:** Northeast **Description:** Feature S - White bracket highlights scarp face.	

Photo No: 4 **Photo Date:** 8/22/2012 **Orientation:** Northeast **Description:** Feature O - White bracket highlights scarp face.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 5	
Photo Date: 8/5/2011	
Orientation: Northeast	
Description: Feature C	

Photo No: 6	
Photo Date: 8/22/2012	
Orientation: Northeast	
Description: Feature C - Close-up of scarp face. Height is 3.3 feet on survey rod.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 7 **Photo Date:** 8/5/2011 **Orientation:** Northeast **Description:** Feature B - White bracket highlights vertical portion of scarp face.	

Photo No: 8 **Photo Date:** 8/24/2012 **Orientation:** East **Description:** Feature AC - White bracket highlights scarp face.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 9 **Photo Date:** 8/24/2012 **Orientation:** East **Description:** Feature AD - White bracket highlights scarp face.	

Photo No: 10 **Photo Date:** 8/24/2012 **Orientation:** East **Description:** Feature AE	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 11	
Photo Date: 8/5/2011	
Orientation: Southeast	
Description: Feature AG	

Photo No: 12	
Photo Date: 8/23/2012	
Orientation: Southeast	
Description: Feature AH	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 13	
Photo Date: 8/24/2012	
Orientation: Southeast	
Description: Feature AJ	

Photo No: 14	
Photo Date: 8/24/2012	
Orientation: Southeast	
Description: Feature AL - White bracket highlights scarp face.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

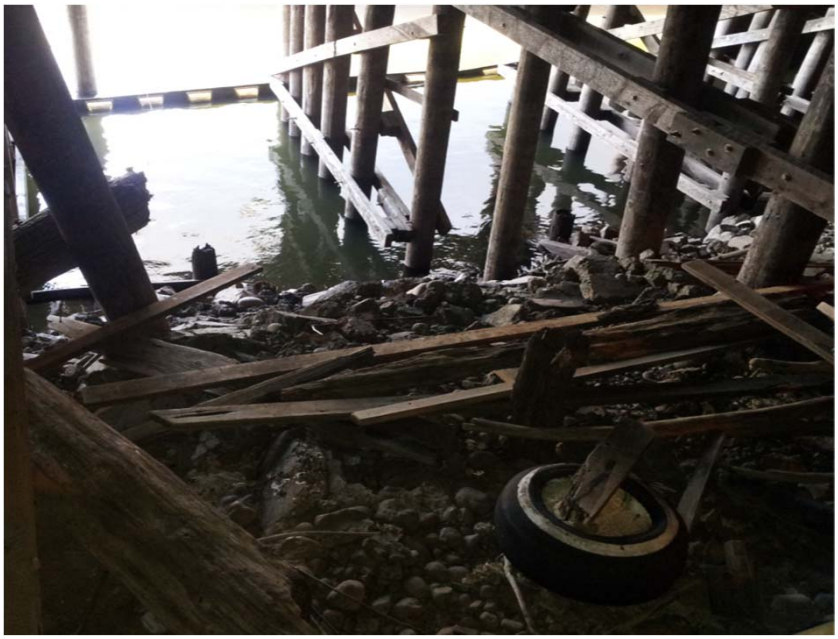
Photo No: 15 **Photo Date:** 8/24/2012 **Orientation:** Northeast **Description:** Feature AN - Example of erosion rill on riverbank slope.	

Photo No: 16 **Photo Date:** 8/23/2012 **Orientation:** Southwest **Description:** Typical location with thin layer of sand present on and surrounded by riprap. Attributed to deposition during periods of high water. See also Photographs 17 and 19).	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 17 **Photo Date:** 8/23/2012 **Orientation:** Southwest **Description:** Typical location with thin layer of sand present on and surrounded by riprap. Attributed to deposition during periods of high water. See also Photographs 16 and 19).	

Photo No: 18 **Photo Date:** 8/24/2012 **Orientation:** Northeast **Description:** Typical view toward river.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 19	
Photo Date: 8/24/2012	
Orientation: South	
Description: Typical location with thin layer of sand present on and surrounded by riprap. Attributed to deposition during periods of high water. See also Photographs 16 and 17).	

Photo No: 20	
Photo Date: 8/20/2012	
Orientation: Southwest	
Description: Feature AQ - Taken from outer catwalk. Disconnected section of outfall pipe in bottom center of photograph. See photographs 21 and 22.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 21 **Photo Date:** 8/22/2012 **Orientation:** North **Description:** Feature AQ - Taken from inner catwalk. Disconnected section of outfall pipe in center right of photograph. Note small cove corresponding to outfall location.	

Photo No: 22 **Photo Date:** 8/22/2012 **Orientation:** West **Description:** Feature AQ - Taken from inner catwalk. Scarp and bare soil upslope of outfall pipe around sheet pile wall.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 23 **Photo Date:** 8/24/2012 **Orientation:** Northeast **Description:** Typical view toward river.	

Photo No: 24 **Photo Date:** 8/22/2012 **Orientation:** Southwest **Description:** Feature AU	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 25 **Photo Date:** 8/21/2012 **Orientation:** Southeast **Description:** Feature AU - This feature is located under the outfall pipe in the upper right of the photograph. A section of this outfall pipe was observed on the riverbank further east.	

Photo No: 26 **Photo Date:** 8/21/2012 **Orientation:** Southwest **Description:** Feature AX	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 27 **Photo Date:** 8/21/2012 **Orientation:** South **Description:** Feature AY	

Photo No: 28 **Photo Date:** 8/20/2012 **Orientation:** Northwest **Description:** Feature AY - Erosion along top of riverbank as indicated by rough edge of asphalt-concrete adjacent to catch basin. Note the segments of the outfall pipe that are disconnected in the lower right of the pthotograph. See also photograph 29.	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 29	
Photo Date: 8/20/2012	
Orientation: Northwest	
Description: Feature AY - Riverbank under disconnection segments of outfall pipe.	

Photo No: 30	
Photo Date: 8/5/2011	
Orientation: Southeast	
Description: Feature BA	

Attachment A
PHOTOGRAPH LOG

Project Name: Swan Island Upland Facility, OU1 **Client:** Port of Portland
Project Number: 1115-06 **Location:** Portland, Oregon

Photo No: 31	
Photo Date: 8/21/2012	
Orientation: Southwest	
Description: Feature BD - Operable Unit 3 boundary to left of the photograph.	

Attachment B

Standard Operating Procedures 2.1 and 2.2

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides instructions for standard field screening. Field screening results are used to aid in the selection of soil samples for chemical analysis. This procedure is applicable during all Ash Creek Associates (ACA) soil sampling operations.

Standard field screening techniques include the use of a photoionization detector (PID) to assess for volatile organic compounds (VOCs), for the presence of separate-phase petroleum hydrocarbons using a sheen test. These methods will not detect all potential contaminants, so selection of screening techniques shall be based on an understanding of the site history. The PID is not compound or concentration-specific, but it can provide a qualitative indication of the presence of VOCs. PID measurements are affected by other field parameters such as temperature and soil moisture. Other field screening methods, such as screening for dense non-aqueous phase liquid (DNAPL) using dye or UV light, are not considered "standard" and will be detailed in the site-specific sampling and analysis plan (SAP).

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- PID with calibration gas (record daily calibration/calibration check in field notes);
- Plastic resealable bags (for PID measurement); and
- Glass jars or stainless steel bowls (for sheen testing).

3. METHODOLOGY

Each soil sample will be field screened for VOCs using a PID and for the presence of separate-phase petroleum hydrocarbons using a sheen test. If the presence of DNAPL is suspected, then screening using dye and UV light may also to be completed. For information regarding screening using dye or UV light, refer to the site specific sampling and analysis plan.

PID lamps come in multiple sizes, typically 9.8, 10.6, and 11.7 electron volts (eV). The eV rating for the lamp must be greater than the ionization potential (in eV) of a compound in order for the PID to detect the compound. For petroleum hydrocarbons, a lamp of at least 9.8 eV should be used. For typical chlorinated alkenes (dichloroethene, trichloroethene, tetrachloroethene, or vinyl chloride.), a lamp of at least 10.6 eV should be used. The compatibility of the lamp size with the site constituents should be verified prior to the field event and will be detailed in the site-specific SAP.

PID Calibration Procedure: The PID used on-site should be calibrated daily or more frequently if needed. Calibration of the PID should be documented in field notes. Calibrations procedures should be conducted according to the manufacturer's instructions. .

<u>PID Screening Procedure:</u>

- Place a representative portion (approximately one ounce) of freshly exposed, uncompacted soil into a clean resealable plastic bag.
- Seal the bag and break up the soil to expose vapors from the soil matrix.
- Allow the bag to sit to reach ambient temperature. Note: Ambient temperature and weather conditions/humidity should be recorded in field notes. Changes in ambient temperature and weather during the field work should also be recorded, as temperature and humidity can affect PID readings.
- Carefully insert the intake port of the PID into the plastic bag.
- Record the PID measurement in the field notes or boring logs.

<u>Sheen Test Procedure:</u>

- Following the PID screen, place approximately one ounce of freshly exposed, uncompacted soil into a clean glass jar or stainless steel bowl.

- Add enough water to cover the sample.
- Observe the water surface for signs of discoloration/sheen and characterize

No Sheen (NS)	No visible sheen on the water surface
Biogenic Film (BF)	Dull, platy/blocky or foamy film.
Slight Sheen (SS)	Light sheen with irregular spread, not rapid. May have small spots of color/iridescence. Majority of water surface not covered by sheen.
Moderate Sheen (MS)	Medium to heavy coverage, some color/iridescence, spread is irregular to flowing. Sheen covering a large portion of water surface.
Heavy Sheen (HS)	Heavy sheen coverage with color/iridescence, spread is rapid, entire water surface covered with sheen. Separate-phase hydrocarbons may be evident during sheen test.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods used for obtaining surface soil samples for physical and/or chemical analysis. For purposes of this SOP, surface soil (including shallow subsurface soil) is loosely defined as soil that is present within 3 feet of the ground surface at the time of sampling. Various types of sampling equipment are used to collect surface soil samples including spoons, scoops, trowels, shovels, and hand augers.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Spoons, scoops, trowels, shovels, and/or hand augers. Stainless steel is preferred.
- Stainless steel bowls
- Laboratory-supplied sample containers
- Field documentation materials
- Decontamination materials
- Personal protective equipment (as required by Health and Safety Plan)

3. METHODOLOGY

Project-specific requirements will generally dictate the preferred type of sampling equipment used at a particular site. The following parameters should be considered: sampling depth, soil density, soil moisture, use of analyses (e.g., chemical versus physical testing), type of analyses (e.g., volatile versus non-volatile). Analytical testing requirements will indicate sample volume requirements that also will influence the selection of the appropriate type of sampling tool. The project sampling plan should define the specific requirements for collection of surface soil samples at a particular site.

Collection of Samples

- Volatile Analyses. Surface soil sampling for volatile organics analysis (VOA) is different than other routine physical or chemical testing because of the potential loss of volatiles during sampling. To limit volatile loss, the soil sample must be obtained as quickly and as directly as possible. If a VOA sample is to collected as part of a multiple analyte sample, the VOA sample portion will be obtained first. The VOA sample should be obtained from a discrete portion of the entire collected sample and should not be composited or homogenized. Sample bottles should be filled to capacity, with no headspace. Specific procedures for collecting VOA samples using the EPA Method 5035 are discussed in SOP 2-7.
- Other Analyses. Once the targeted sample interval has been collected, the soil sample will be thoroughly homogenized in a stainless steel bowl prior to bottling. Sample homogenizing is accomplished by manually mixing the entire soil sample in the stainless steel bowl with the sampling tool or with a clean teaspoon or spatula until a uniform mixture is achieved. If packing of the samples into the bottles is necessary, a clean stainless steel teaspoon or spatula may be used.

General Sampling Procedure:

- Decontaminate sampling equipment in accordance with the Sampling and Analysis Plan (SAP) before and after each individual soil sample.
- Remove surface debris that blocks access to the actual soil surface or loosen dense surface soils, such as those encountered in heavy traffic areas. If sampling equipment is used to remove surface debris,

the equipment should be decontaminated prior to sampling to reduce the potential for sample interferences.

- When using a hand auger, push and rotate downward until the auger becomes filled with soil. Usually a 6- to 12-inch long core of soil is obtained each time the auger is inserted. Once filled, remove the auger from the ground and empty into a stainless steel bowl. If a VOA sample is required, the sample should be taken directly from the auger using a teaspoon or spatula and/or directly filling the sample container from the auger. Repeat the augering process until the desired sample interval has been augered and placed into the stainless steel bowl.

Backfilling Sample Locations:

Backfill in accordance with federal and state regulations including OAR 690-240 (e.g., bentonite requirements). The soils from the excavation will be used as backfill unless project-specific or state requirements include the use of clean backfill material.

Attachment C

Laboratory Analytical Report (CD-Rom)